Game Changing Development

Astrobotic Software Defined Reliability (ACO-ASDR)

Completed Technology Project (2017 - 2019)

Project Introduction

Astrobotic is developing a software-defined reliability system (A-SDR) for high performance, high reliability computing. Traditional radiation hardening techniques introduce significant delays between processor advances and availability for spaceflight applications. A-SDR uniquely allows high-throughput processing to be integrated with real-time control systems while ensuring correctness under radiation induced single event effects. This is enabled by application of modern distributed systems advances developed for the "cloud" to embedded real-time computing. "Virtual Synchrony" allows a cluster of processors to compare state and observations without a master and with low latency. Astrobotic's proof of concept is a demonstration of a high throughput convolutional deep neural network performing reliable handwriting recognition at 25 Hz with randomly inserted data errors. This concept has been demonstrated to operate in real-time in a virtualized three node configuration and on embedded COTS processors connected through Gigabit Ethernet. The objective of this task is to leverage NASA's expertise in redundant computing, real-time systems, and radiation tolerant electronics to mature Astrobotic's software proof of concept into a product-ready TRL 6 system and design a preliminary reference hardware design. Astrobotic is investing in this technology development because it believes it can utilize its software expertise and experience in space computing selection to produce a product that is appropriately positioned at the nexus of capability, reliability, ease of use, and price.

Anticipated Benefits

This product, which is critical to the company's own ambitions, will enable spacecraft to perform more autonomous in-space activities. A successful program will allow Astrobotic to capture a large percentage of the growing spaceflight computation market, which is projected to be worth $1.1B by 2020. This capability also has broad applicability to future NASA and OGA spaceflight and terrestrial applications as the autonomy and computing needs of manned and unmanned vehicles grows. With Core Flight Executive integration, NASA developers will be able to rapidly deploy both general purpose and mission specific flight software to COTS hardware in a reliable manner. The scalability of A-SDR also enables robust processing for cubesats and small satellites to minimize end-user software complexity, maximize onboard computing performance, minimize downlink bandwidth.

Astrobotic Software Defined Reliability

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

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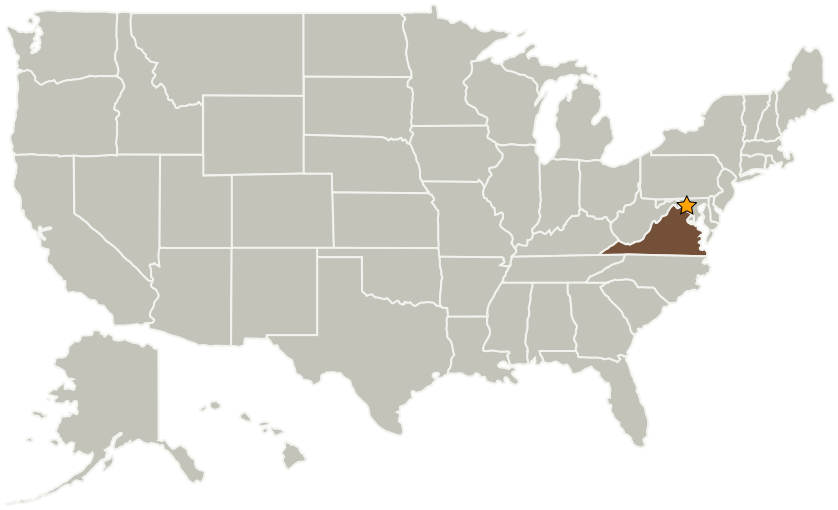
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Virginia

Project Transitions

October 2017: Project Start

October 2019: Closed out

Project Management

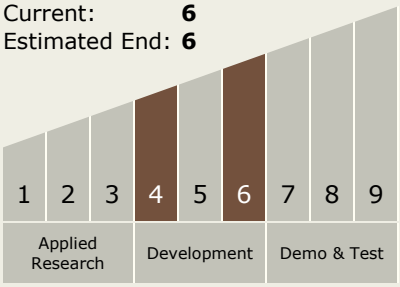
Program Director:
Mary J Werkheiser

Program Manager:
Gary F Meyering

Principal Investigator:
Thomas P Flatley

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Target Destinations

Earth, The Moon, Mars, Others Inside the Solar System